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ABSTRACT

A proposed interdisciplinary course linking the areas of English and data processing is described in this paper. Expertise in both fields is perceived as a function of the processes of defining, recreating metaphors and models, locating assumptions within messages, and becoming aware of meaning. Potential enrollees include both students in the humanities and those in the sciences. Issues dealing with the relationship between human and machine are defined in order to stimulate ethical and philosophical problem solving. Suggested activities include exercises using computer languages, translations from programming systems to edited English, expository prose investigating the human/machine relationship, and games simulating social and cultural conditions. Appendixes include a course outline and a reading list (largely science fiction) as well as a reprint of a "New York Times" editorial dealing with the rights of the dying in a technological society. (KS)

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WRITING AS PROBLEM-SOLVING IN INTERDISCIPLINARY PROGRAMS:

Literature and the Age of Technology

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When we talk about "writing" as problem solving, we mean writing as a means of inquiry: to question and explore an issue or problem. Every discipline has its own problems and concerns but interdisciplinary programs encourage students to transcend departmental boundaries, synthesize information, reformulate concepts and develop writing skills in the process.

"Interdisciplinary" has generally not been geared for remedial writing, but Freshman Comp., or "intensive writing," whatever you call a first year course, needs interdisciplinary thinking. As soon as you write about something, you deal with the ordering of a body of knowledge--its metaphors, models, concepts, and data--in the humanities as well as sciences.

One way the English teacher alone in the classroom can easily function as an "interdisciplinary" thinking stimulus is by using some kind of simulation technique and not the isolated reading of essays from psychology and political science found in current rhetorics. I tried Taking Action by Lynn Quitman Troyka and Jerrold Nudelman (1975), a collection of simulation games where the students represent different factions in role playing. The course was not called "interdisciplinary;" it was a "remedial" writing course. What happened was that students forgot that they "can't write" and that they were taking a "remedial" course.

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They read materials that defined a particular problem. For example, we had a game on population control in the year 2200. What the students had to do was recognize the constraints of that particular problem while using vocabulary, material, and fictional situations similar to current problems. We talked in terms of how to deal with a problem by defining it, and knowing, in mathematical terms, what is given.

As a teacher working alone in a writing program, the notion of "definition of the problem" was easy to handle once the students had been presented a particular problem with its constraints: how do you select parents when more people want to have children than government regulations allow? As presented in Taking Action, three different birth permits were allowed for five parent-applicants. Contraception was universal, so parenthood was legally limited and controlled. The students had to take the roles of various parent-applicants and argue for the tangible as well as intangible characteristics defined and implied in the text. Without my suggesting it, they began to question the destruction of individual freedom by the control board and to see contemporary analogues to the Population Control Board. Thus, new problems and questions, which the students investigated independently and wrote about, evolved out of that skeletal situation.

Data processing, in turn, is a "problem" or "program" solving course that relies on English prose more than students generally anticipate. What we try to do in Data Processing at a 2-year college is, basically, train people to learn how to program computers, do systems analysis, and, hopefully, go out into the real world and obtain entry level jobs. The big problem is

that the language becomes very technical and students have to learn to explain their work in everyday English to nontechnical managers, accountants, and businessmen. The problem is making a highly technical vocabulary understandable to anyone, by not relying on the machine model as the metaphor.

How different is a memorandum asking for or justifying the purchase of additional equipment from a kind of composition you might write in English classes? The answer is probably very little. Some of the terms may change, but the organization and the function are essentially the same.

In Data Processing, there are two systems oriented courses that require people to write memoranda to potential users: "Would you like a computer system?" And someone always says, "Yes, I would. What can you do for me?" The focus is really writing prose descriptions on what the system does and the students' understanding of what the user requires--stated in layman's language, instead of technical terms. The whole series of memoranda goes back and forth in another course while the students are actually programming and designing the system that they will deliver to the user at the end of the term. Typical users in the college are the library, the registrar's office, and the office of institutional research. The students have to do a wide range of writing and they find out that the English Comp. course that they hated, suddenly becomes very important, because correspondents will return papers, saying, "This doesn't make sense." It's much too late that students realize that it's not what they know, but how they can present it. Certainly in the field of data processing, most of the presentation is done by memo. There's very

little people interaction. The response to what a user wants is rarely an oral presentation; it's a written document. If a student presents that poorly, one infers that he understands poorly what the user wants.

What they do find out is that users don't specify their requirements very carefully, and they say, "I really should have asked him, but I thought he meant..." In the process of interacting on real problems, they learn "hidden assumptions". The registrar may also learn that students had their own meaning attached to a request. From that point of view, data processing becomes interdisciplinary. The sad part is that this is the last course of the program and the English course is usually way behind them.

Students at BMCC/CUNY also practice writing programs alone, but that isn't what really happens in the real world. People rarely write programs in isolation; each person in a group writes a program that is only an element of a common system. A person who is used to writing programs alone has to then learn to interact with a group of 7 to 12.

What is interesting is that Dan and I were teaching the same thought processes separately in our respective departments: the process of defining, recreating metaphors and models, looking for the hidden and apparent assumptions in any kind of message, and, of course, trying to increase the students awareness of how meaning was conveyed in whatever language they either wrote or read.

When Dan and I were first asked to join our disciplines, English and Data Processing, in what had originated as a data

processing course, "Computers & Society," we realized that we couldn't teach the course in lecture rotation where I would present my thoughts one day and Dan would present his thoughts another day--disjointed, like two separate courses. We realized that we had to be in the classroom together, interacting, so that students would see inter-thinking and debating in vivo and that the disciplines were connected because the instructors were using some of the same thinking processes to engage the students in thinking and questioning. So what we did was to develop a course where writing attempted to explore certain problems that both disciplines raised.

The syllabus was designed for a 6 hr/wk. program, meeting in three 2-hr. periods. This would permit a variety of teaching procedures: in-class writing, debates, discussions, and computer interaction. In order to present the kind of interdisciplinary program described, both of us would be in the classroom doing the exercises together with the students.

Potential enrollees would include: (a) humanities majors needing an elective in business or science who had completed the English requirement and were interested in an introduction to scientific "arts"; (b) data processing students who had completed their English requirements and data processing sequence and hoped to relate their technical skills to human concerns, and (c) beginning students who had completed the English requirement but were unsure of majoring in data processing. This program would have served as an introduction without having to experiment directly with a data processing course. Unfortunately, it was never offered at BMCC, the unit of CUNY it was originally designed, due to budget cuts.

Although the natural sciences and the humanities may differ in focus and content, they're clearly engaged in the same process of symbolizing, classifying, and organizing information and concepts. The purpose for asking and answering questions in each discipline may be practical or sometimes philosophical and touch upon universal human concerns. Questions about how to program as well as what am I programming for would be asked in an interdisciplinary data processing/humanities course. The problem we faced in developing the course was how to teach students something about data processing and literature as "disciplines" and to write effectively at the same time. Concerns about subject-verb agreement became subordinate to stimulating thinking. Certainly grammar would be dealt with as it was needed with the editing and correction of computer programs as well as English prose.

We formulated questions and concerns in both disciplines for which neither discipline alone could offer an adequate answer. Each discipline had a body of literature which presented one side of the problem. There are, however, metaquestions transcending the immediate concerns of both disciplines. The valuable interdisciplinary program questions the myths and beliefs attached to the goals of the discipline, as in the questions raised by Arthur C. Clarke in one of the stories in the syllabus, "The Nine Billion Names of God", (see Appendix A). The inquiry method was used in defining crucial problems for a focus in writing assignments, class readings, and discussions.

The kinds of questions on the syllabus are probably seminar topics in themselves, so we wouldn't expect people to develop greatly detailed papers. What we would encourage, however, is an

awareness of the problems and certainly an ability to articulate it. The questions on page one of the appended syllabus were asked in the literature of both disciplines. If the students started with at least that frame of reference, they would then begin to formulate their own questions and find some kind of answer or non-answer from the literature.

WRITING TOWARD PROBLEM SOLVING

We thought of starting the writing spontaneously with a definition of "man," and one for "machine". As the course would evolve, this definition would be revised, expanded, and would reflect new knowledge. They might, for example, start the first phase by talking about traits that were mutually exclusive, "You can plug in a machine, but humans have emotions." These ideas would be written freely and shared during the first week.

The second week, we would ask them to find definitions and characteristics of each in the literature. They would find these from their readings--the metaphors of poets and the textual references from Computers and Society--so that they would be engaged in some kind of purposeful research.

Writing Problem #1: Develop thinking and defining processes. (1) Weekly additions to a comparative definition of man and machine, written spontaneously in class (2) followed by definitions quoted from writers in science and literature taken from reading assignments and other sources and (3) formulating ethical and social questions arising from man and machine definitions.

Many of the ethical and philosophical questions evolve directly from the definitions of man and machine. The case of Karen Quinlan is an example of how problematical the definitions can be. Here's an editorial I took from the New York Times

(see Appendix B) which raises just that question: When is a person's life separate from the "life" of the machine?" Even this editorial writer never came to a conclusion as to what to determine. But what we will have to make clear is that in spite of complex issues with uncertain boundaries, we, as individuals, will have to take a stand. The boundaries are not clear in the law courts or the medical profession. As technology changes, they're going to become less clear. We want to encourage this process of inquiry and redefinition while reminding our students that the definition of man/machine is on-going in terms of the changes in the technological world as well as the legal world. Some of these questions cannot be so readily answered, but students, nevertheless, will be inquiring in their writing.

Sometimes the written inquiry is immediate and practical. For example, students find out when they have a mistake on a Con. Edison bill that there is no person behind the "customer service" number, but the "computer". They become more aware that the machines and not humans are impinging upon their lives. I've seen people get into lengthy correspondence with these machines. There are people and there are machines, but it isn't so clear, certainly in crediting situations, who is doing what.

The difference between this and other composition/literature courses is that this would develop a notion of "system". For example, students would learn some minimal amount of a computer language as a communication "system" and would write "mini"-programs. There would be practical experience "writing" a program and writing English prose as a "system" of inquiry.

Unfortunately, in data processing courses alone, there is

very little transfer between writing elegant programs and writing elegant English prose. Students have to be very careful with synthetic languages like BASIC and FORTRAN, but they have never corrected their slovenliness with English from elementary school on. In the "natural" language, English, they could omit and misuse words, and people might still get their meaning, but this doesn't hold true for BASIC and FORTRAN. They become very frustrated when their whole program is thrown out by the machine because of one omitted comma.

By teaching English composition and data processing together, instead of in checkerboard compartments, our hope was to transcend the separateness by demonstrating the step by step explanations that were mutually part of the process in writing for a machine or writing for a human. There are many differences as well; there are many "holes" in a paragraph that can't be allowed in a program. Yet, in both, you are dealing with grammar, the structure of the statement, and with the signals. Before we approached the philosophical and moral problems, students would be working with programs and translating them into English prose, to see implicitly the difference in the processes with representatives of both disciplines there to answer questions. I think that makes a difference!

They often think that a businessman or data processor is not concerned with English prose or that you don't have to be as precise for humans as you do for machines. If students were asked to translate a poem by John Donne into a computer language, they would also learn, in the process, that there are things you can't translate. Yet there may be some basic patterns; there may be a "grammar" in poetry.

Writing Problem #2:

Learning and using a computer language for writing "mini"-programs. Communication with a machine by a series of step by step instructions and the description of these instructions to another person as two different aspects of the same "content".

Students will engage in a variety of games and simulation activities with the computer such as Tic-Tac-Toe, Checkers, Chess, and landing a spaceship on the moon.

Writing Problem #3:

Translations from one system to another, i.e., a programming system to edited English. An implicit understanding of language, its grammar, and signals, step by step explanations, assumptions behind statements in both versions and logic will be developed.

Students will find in both the technical and literary metaphors the ethical implications of anthropomorphizing the machine world as well as mechanizing the human. Their interaction with the computer would give them real experience with man/machine boundaries. Writing and research in the initial stages would lead into more complex "What if?" situations. What if your teacher is a machine and gives you encouragement?

Suppes at Stanford has contended that you can't leave elementary education in the hands of people since the human teacher tends to recognize and reinforce the "clean, bright kids," whereas the "shabby kid" in the back of the room is totally neglected. This is too dangerous. But you can program machines that will provide reinforcement on the right answer regardless of the students' style of dress.

At MIT, there is a program where the computer is used as a

psychotherapist. Clients are told that your therapist is "dumb", but he can hear so that all of the answers you get will be typed out. Many psychotherapists have examined the interactions and have determined that that would be the way they would have handled the questions. That is a monument to very clever programming. It's a case with routine interactions, where people can't really differentiate between machine and human responses.

Writing Problem #4:

Expository prose using "What if...?" situations: students would select from a variety of

situations to respond to, such as:

What if students were not taught arithmetic but only how to use a calculator?

What if your teacher were a machine?

What if your psychotherapist were a machine and "it" asked, "Would you be disturbed to find out that I am a machine?"

What if you, as a technocrat, were asked to do something morally repugnant?

We may ask, "Who is alive?" There are now computers that fix themselves. Computers that are beginning to "resemble" people are at the forefront of artificial intelligence. Unfortunately, people mistake any solution for the optimal solution. They need to get a realistic idea of the trade-offs involved and the ethical and value judgments that will have to be made.

What happens, for example, if we replace the judges of the Population Control Board in Taking Action by a computer, where the computer is programmed to recognize tangible characteristics which are coded: height, hair color, sex, level of education, etc. And the computer says, "We're denying you a permit to have children." The student feels that something is radically wrong and wants to

circumvent the system. How could one go about doing that? What kind of appeals could one make? The arguments that one might make before the Population Control Board would be radically different from those to the computer programmer, whose rules, once made, are usually inflexible. Computers don't have compassion or mercy and computers are not moved by persuasive discourse...but they do "write" "poetry".

Writing Problem #5:

Simulation game/discussion/writing.

An exploration of a concept of

"technological justice". A popu-

lation control board in the year 2200 (a modification of the population control game in Taking Action by Troyka and Nudelman) where the board consists of programmers setting up criteria for parenthood. You don't have the tangible attributes recognized by the computer: education, experience, and wealth. You do, however, have the intangible attributes of patience, understanding, and warmth. What do you say to the programmers to change the model and/or defend the significance of the intangible attributes?

During the last phase of the course, the students could investigate questions of values and ethics in longer papers. The questioning would also be stimulated from the reading throughout the course. For example, "The Nine Billion Names of God," by Arthur C. Clarke, can demonstrate one of the ways these moral questions would evolve.

In this story, a group of Tibetan monks comes to computer programmers for a print-out of the nine billion names of God. Their scribes have been writing the names for centuries, but obviously modern technology would accelerate the recording. The religious monks believe that when the nine billionth name is

recorded, the world would come to an end. In accepting the "job," however, the technocrats think that they're pulling a great "con". They can deliver the "output," but do not perceive their connection to the objectives. They go to Tibet to set up shop, but they begin to think that they may be punished for selling their services to foolish primitives who are not going to get the Judgment Day they anticipate. In addition, the continuity of the world will be perceived as their failure as programmers...a modern dilemma. After the program is finished, however, the technocrats try to leave before its run, but on their way to the airport, one notices that the stars are going out. The story ends.

The "believers" of one discipline called upon the engineers of another to solve a problem that had many moral questions and problems--technological exploitation and the destruction of the world. Indeed, both groups have cooperated in destroying the world. In spite of the objectivity or neutrality the technocrats may assume in any project, they may actually engage in a process that accelerates the destruction of the human race and the world. Whether they are called upon by Tibetan monks or whether they are called by some government agency to violate human value and existence, they need to ask questions about the processes and objectives of their program.

In science fiction, highly trained scientists like Arthur C. Clarke and Isaac Asimov raise the moral questions of their own fields in fiction. Their works are excellent models of problem solving in interdisciplinary writing. How far do we go? Every technological act involves human concerns and awareness of human nature and human values.

Writing Problem #6:

A longer, investigative paper.
A question of concern devised
by the student. Examples would
include an investigation and discussion of one of the
questions on the syllabus or an area in which current
technology forces us to redefine and re-evaluate the life/
death and man/machine duality.

This course would not be a checkerboard attachment of two
disciplines. The point is that both disciplines and the teachers
involve more complex interactions of feelings-thoughts-intuitions,
etc., than simply a bifurcation of logical thinking in data
processing and poetic expressions in English.

APPENDIX "A"

LITERATURE AND THE AGE OF TECHNOLOGY

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and

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DESCRIPTION

This course will explore the impact of machines and technology on science fiction, fantasy, and utopian literature. As an interdisciplinary course with the Data Processing Dept., the focus will be on the computer as the major metaphor of man's technology and the literature that is most directly concerned with the key problems created by the man/society/computer interaction.

Students will have the opportunity to explore the answers to key questions raised in modern literature and computer science:

1. To what extent are machines a blessing or a curse?
2. Where does man end and machine begin?
3. What insights do fiction, myths, and metaphor express in the man/machine relationship?
4. Are man/machine ethics possible? If so, what new definitions and priorities must be set?
5. What is the impact of "fiction" and fantasy on technology? And the converse, what is the impact of technology on fiction?

Most of the material of the course will be covered through independent readings, class discussions, films, art, group presentations, debates and written assignments.

The literature will be selected so that students will have a broad view of the importance of this theme in form and content from Biblical and mythical writings to contemporary science fiction and utopian writings of Orwell, Butler, Skinner, Clarke, Vonnegut, Asimov, etc. Needless to say, the reading list is flexible and can be geared to student interest and reading skill.

SUGGESTED TEXTS: Literature

1984, G. Orwell

I, Robot, I. Asimov

2001: Space Odyssey, A. C. Clarke

Player Piano, K. Vonnegut

Survival Printout, edited by Allison, Jenkin and Perrault

Men and Machines, edited by R. Silverberg

Beyond Control, edited by R. Silverberg

Speculations: an introduction to literature through fantasy
and science fiction, edited by T. E. Sanders

Of Men and Machines, edited by A. O. Lewis, Jr.

SUGGESTED TEXT: Data Processing

Computers and Society, S. Rothman and C. Mosmann

TOPICAL OUTLINE

- I. Introduction to Man and Machines: Definitions for the following terms will be explored in a wide range of literature: man, machine, computer, robot, automaton, automation, and feedback. The implications of these definitions for a man/machine interaction in our society will be discussed.

After a short history of the development of technology with special reference to computers, this section will focus on a critical examination of some of the seminal questions on the nature of man and the effect of his creations. Mankind will be discussed chiefly as a creator of techniques and machines to order his world. In conjunction with this view, a consideration of the split between the Apollonian and Dionysian qualities of humanity, analogous to the science/art dichotomy, will demonstrate some of the complications involved. These complications raise questions about the good and evil of his creations and the limits of man's knowledge and power.

Suggested Readings: Genesis; Prometheus myth; Daedalus/Icarus myth; the Sorcerer's Apprentice theme; Frankenstein, M. Shelley; I, Robot, I. Asimov; The Pacchae, Euripides.

Short Story Selections

"Nine Billion Names of God," A. C. Clarke
"For a Breath I Tarry," R. Zelazny
"Shadow Show," C. Simak
"Epicac," K. Vonnegut
"The Pi Man," A. Bester
"The Electric Ant," P. K. Dick
"Working in the Spaceship Yards," B. Aldiss

- II. The nature of the man/machine interaction: This section will deal with the illusions of this interaction. Since the machine has often been regarded as man's salvation, utopian literature will be considered here:

Suggested Readings: Erewhon, Butler; 1984, Orwell; Ezekiel; selections from Gulliver's Travels, Swift; selections from The Republic, Plato; Walden Two, B. F. Skinner; "The Dynamo and the Virgin," H. Adams.

Short Story Selections

"The Iron Chancellor," R. Silverberg
"But Who Can Replace a Man?" B. Aldiss
"Scanners Live in Vain," C. Smith

- III. This section will attempt to answer two crucial questions: a) are machines a blessing or a curse? b) who will guard the guards? The man/machine interaction will be examined in terms of the master/slave relationship. A concept of "technological justice" will be explored.

Suggested Readings: Catch-22, J. Heller; selections from The Republic, Plato; God and Golem, Inc.: A Comment on Certain Points where Cybernetics Impinges on Religion, N. Wiener; Player Piano, K. Vonnegut.

Short Story Selections

"I Have No Mouth and Must Scream," H. Ellison
"Autofac," P. H. Dick
"Fondly Fahrenheit," A. Bester

- IV. The Future: the last section will be concerned with "where do we go from here?" Do we demythologize progress and efficiency and give up control of the future? Do we find some compromise between man the creator and man the destroyer?

Suggested Readings: selections from the Revelation of St. John the Divine; selections from Future Shock, A. Toffler; Operating Manual for the Spaceship Earth, B. Fuller.

Short Story Selections

"Harrison Bergeron," K. Vonnegut
"The Manned Missiles," K. Vonnegut
"The Subliminal Man," J. G. Ballard

APPENDIX "B"

WRITING AS PROBLEM SOLVING IN INTERDISCIPLINARY COURSES

H. Lee Gershuny and Daniel Rosich

THE LIVING DEAD

(New York Times editorial, Sunday, October 13, 1975, Sec. 4, p. 12)

A new complication has arisen in the labyrinth of perplexities posed by Karen A. Quinlan as she lies comatose in the intensive care unit of St. Clare's Hospital in Denville, N.J., kept alive only by mechanisms that maintain her breathing and permit nutriment to enter her digestive system. A consultant neurologist now reports that she would not fit any of the definitions of death that have been accepted to date.

But though she is capable of spontaneous respiration at times, the physician reports, there is no likelihood that she will ever be able to awake from her coma. In medical jargon, she is in a "chronic vegetative state" and will remain so for an indefinite period of time so long as the artificial means now keeping her alive are sustained. This view is apparently being accepted in the legal debate now scheduled to take place before New Jersey's Superior Court.

From every point of view this makes the case more complex than ever. Previously it had appeared that she might perhaps satisfy the criterion of brain death, a relatively new approach that has gained growing acceptance to meet the problems posed by medicine's increasing ability to maintain physical functions artificially. If the neurologist is correct, Miss Quinlan is alive, though it is a life without sensation, without thought, without joy, without sadness and without prospects for the future except as the machinery continues.

Still the question remains: Should the machinery be kept going with all the huge accompanying emotional cost for the family and the economic cost for the community, or should the decision be that such a "life" is practically equivalent to death and should be terminated?

What we seem to be learning is that the traditional idea of life and death as opposed alternatives is no longer appropriate. The old laws and customs based on the notion that everyone is either alive or not alive, i.e., dead, have been made obsolete by medical progress. The reality now includes a middle ground, chronic vegetative states, as that which Miss Quinlan occupies.

What are the "rights" of such human vegetables and what obligations do their families and the general society have toward them? In the case of fetuses it is now well accepted that by sampling liquids from a pregnant woman's womb -- by the technique of amniocentesis -- physicians can predict the birth of some kinds of monstrously deformed babies for whom no normal life is possible. In many cases now these fetuses are being aborted. Is this a precedent for handling the problems of the living dead.